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To: Forest Supervisor, Sawtooth NF

Enclosed is Forest Health Protection (FHP) Project Report, BFO-PR-2011-01. Included in this report is a summary of the 2010 aerial application of MCH flakes on Bald Mountain Ski Area, and monitoring efforts to report treatment efficacy. Also included are treatment options and a recommended treatment strategy to suppress Douglas-fir beetle activity in 2011.

If you have any questions, please contact Laura Lazarus at 208-373-4226 in the Forest Health Protection Boise Field Office. For more general information on Forest Health Protection programs and services, visit our combined Region 1 and 4 Web site at: http://www.fs.fed.us/r1-r4/spf/fhp/ or visit our national Forest Health Protection Web site at: http://www.fs.fed.us/foresthealth/.

/s/ Dayle D. Bennett (for)
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Director, State and Private Forestry

Enclosure

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BFO-PR-11-01
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Aerial Application of MCH Flakes to Reduce Impacts from Douglas-fir Beetle on Bald Mountain Ski Area in 2010

Ketchum Ranger District

Sawtooth National Forest

By

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ABSTRACT
Populations of Douglas-fir beetle (DFB) began to build in 2009 on Bald Mountain Ski Area (BMSA) in response to the 2007 Castle Rock fire. A treatment strategy including an aerial application of the anti-aggregant MCH was planned for 2010 to (1) protect stands of susceptible Douglas-fir (DF) on the BMSA from undesirable attack and mortality caused by DFB, and (2) to implement the proposed aerial application of MCH flakes in a safe, effective, and efficient manner. DFB attacked 0.5 mean basal area (BA) ft^2/acre, or 0.7 trees per acre (TPA), in treated areas and 21 mean BA ft^2/acre, or 14.7 TPA, in untreated areas. MCH flakes successfully reduced DF mortality when the proper dosage was applied. Lessons learned include influences of treatment block size and wind on flake distribution. Treatment in 2011 is recommended because DFB populations are still high in the area and BMSA is highly susceptible to attack. The suggested treatment for 2011 is one well-timed aerial application of MCH flakes over about 1,500 acres in 2011 in combination with deployment of MCH pouches on approximately 125 acres.

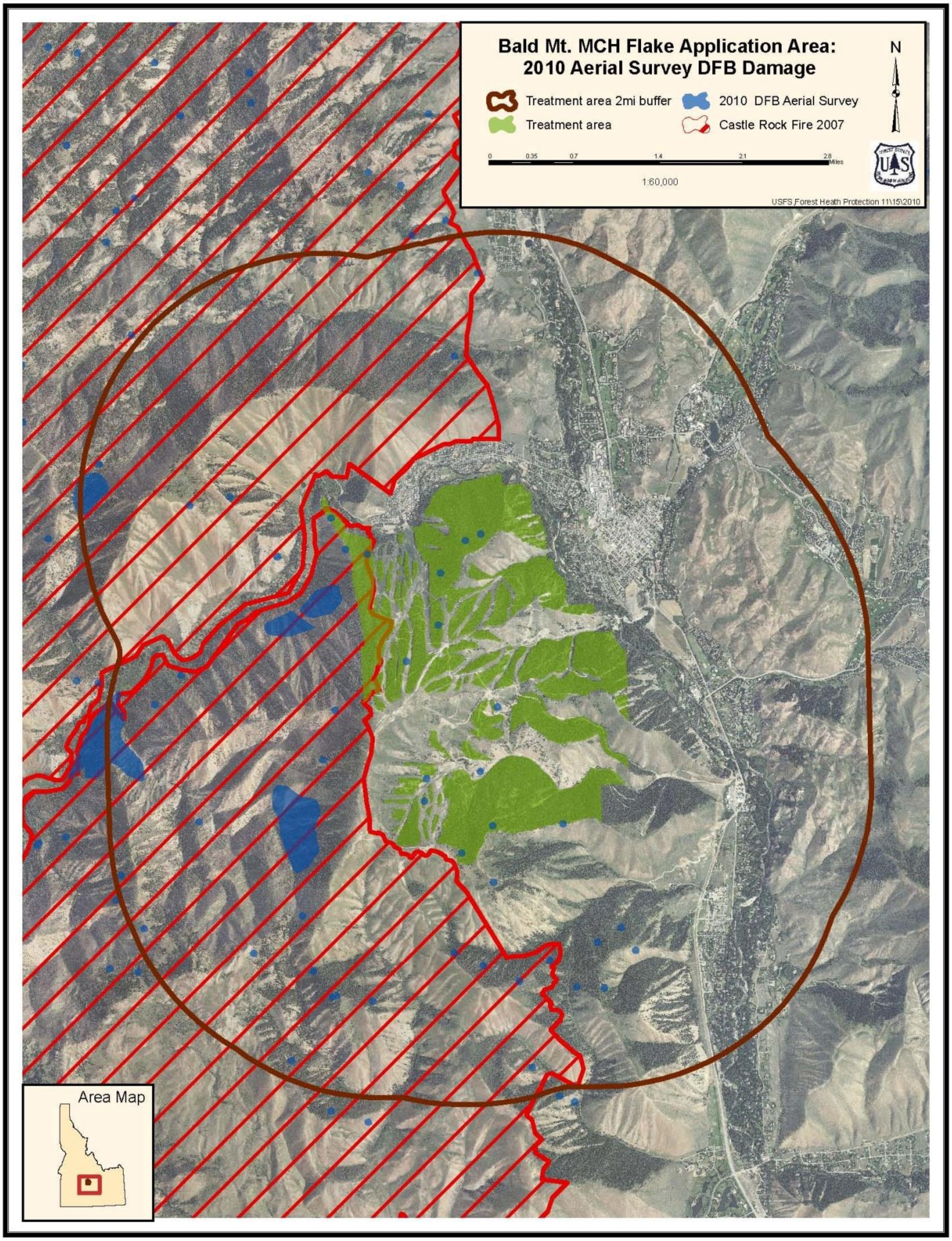
INTRODUCTION
The 2007 Castle Rock fire burned approximately 48,000 acres of Sawtooth National Forest and Twin Falls District, Bureau of Land Management (BLM) public lands, including the southern and western edges of the BMSA (Figure 1). Following that fire, the population of DFB increased in standing, fire-scorched and green DF in and adjacent to the ski area (BFO-TR-2009-07, Lazarus and Hoffman; BFO-PR-2009-01, Lazarus 2009). Predicted tree mortality from these increasing populations of DFB-threatened Forest Service management objectives for the area include visual quality, snow protection, wildlife habitat, wind-scour protection, and ski run delineation on BMSA.

In 2009, the Boise Field Office staff of Forest Health Protection (FHP) assisted the Ketchum District Ranger and his staff in treating two specific areas on the BMSA with MCH (Methylcyclohexanone), pouches. MCH is an effective anti-aggregant pheromone that protects DF from attack by DFB. One of the treated areas, called "Central Park" is a popular glade skiing location, consisting of very large DF. It is adjacent to chronic DFB populations that were thought to be associated with annosus root disease pockets and water stress. The other treated area was Guyer Ridge, the northwest boundary of the ski area and adjacent to the fire perimeter.

By fall 2009, as much as 80 percent of suitable host was attacked along Guyer Ridge and into adjacent large, green standing DF of the northwest boundary of BMSA. This indicated the DFB outbreak would continue to cause additional mortality in the contiguous and highly susceptible stands of DF on BMSA in 2010 (BFO-TR-2009-01, Lazarus 2009). Stands monitored with variable radius plots in 2009 were all rated highly susceptible to DFB as were most other stands visually inspected throughout the majority of the ski area using two rating systems, Stand Hazard Rating for Central Idaho Forests (Steele et.al 1996) and FINDITS (Bentz 2000). Stands with the following criteria were rated as highly susceptible stands: over 120 years of age, over 240 BA, over 50 percent of BA in DF, over 14 inches diameter at breast height (d.b.h.).

Because of the expanding DFB population that now threatened a larger, susceptible, and difficult to access portion of the ski area, FHP recommended an aerial application of MCH flakes. Therefore, two separate aerial applications of Disrupt Micro-Flake MCH bark beetle anti-aggregant flakes were applied to 2000 acres of BMSA. The first treatment occurred on May 5, 2010, with subsequent treatment to the same acres on June 28-29, 2010.

Figure 1. Bald Mountain Ski Area Project Location, Ketchum Ranger District, 2010.



The primary objectives of this project were to (1) protect stands of susceptible DF on the BMSA from undesirable attack and mortality caused by DFB; and (2) to implement the proposed aerial application of MCH flakes in a safe, effective and efficient manner. To assess project results, ground plots were established to monitor treatment effectiveness; baited traps were deployed to monitor DFB populations and flight behaviors; treated and non-treated areas, including riparian areas, were monitored for flake distribution and drift; and, MCH flake elution rates were evaluated.

TREATMENT DESCRIPTION

DISRUPT MICRO-FLAKE® MCH Bark Beetle Anti-Aggregant Flakes, made by Hercon Envrionmental, are three-ply plastic flakes laminated with Methylcyclohexenone (MCH) bark beetle anti-aggregant. These 6mm x 6mm flakes were applied by Columbia Basin Helicopters, Inc., using a Bell UHIH+ helicopter equipped with a SatLock DGPS swath guidance system, including moving maps and light bars. Contract stipulations limited wind speed to 6m/h and deployment of flakes at uniform altitude and speed wherever possible. Flakes were released at about 100 feet above tree canopy. Once calibrated and characterized, the MCH flake delivery system was capable of displaying flow rate, deployment speed, swath width, and discharge at the appropriate rate during the application.

The applied rate was 1.2 kg/acre (2.6 lbs/acre) of flakes, 150 grams of active ingredient (A.I.)/acre, over the 2,000 acres of treatment. The aviation contract cost $36.00 per acre and the flake product cost $79.00 per acre, however, additional costs were incurred. The treatment dosage is half that of the recommended label dosage of 300 A.I. The dosage used in this operational project was based on the published field trials where the largest dose tested was 189 g A.I. that resulted in less than 1 percent of BA attacked (Gillette et. al 2009, Gillette and Mehmel 2009). This attack rate was deemed acceptable to land managers, and since no field trial has been conducted with the 300 g A.I. dosage the lower rate of 150 g was used to treat the maximum amount of acres possible with reasonable levels of protection from new DFB attacks.

TREATMENT EFFICACY EVALUATIONS USING VARIABLE RADIUS MONITORING PLOTS

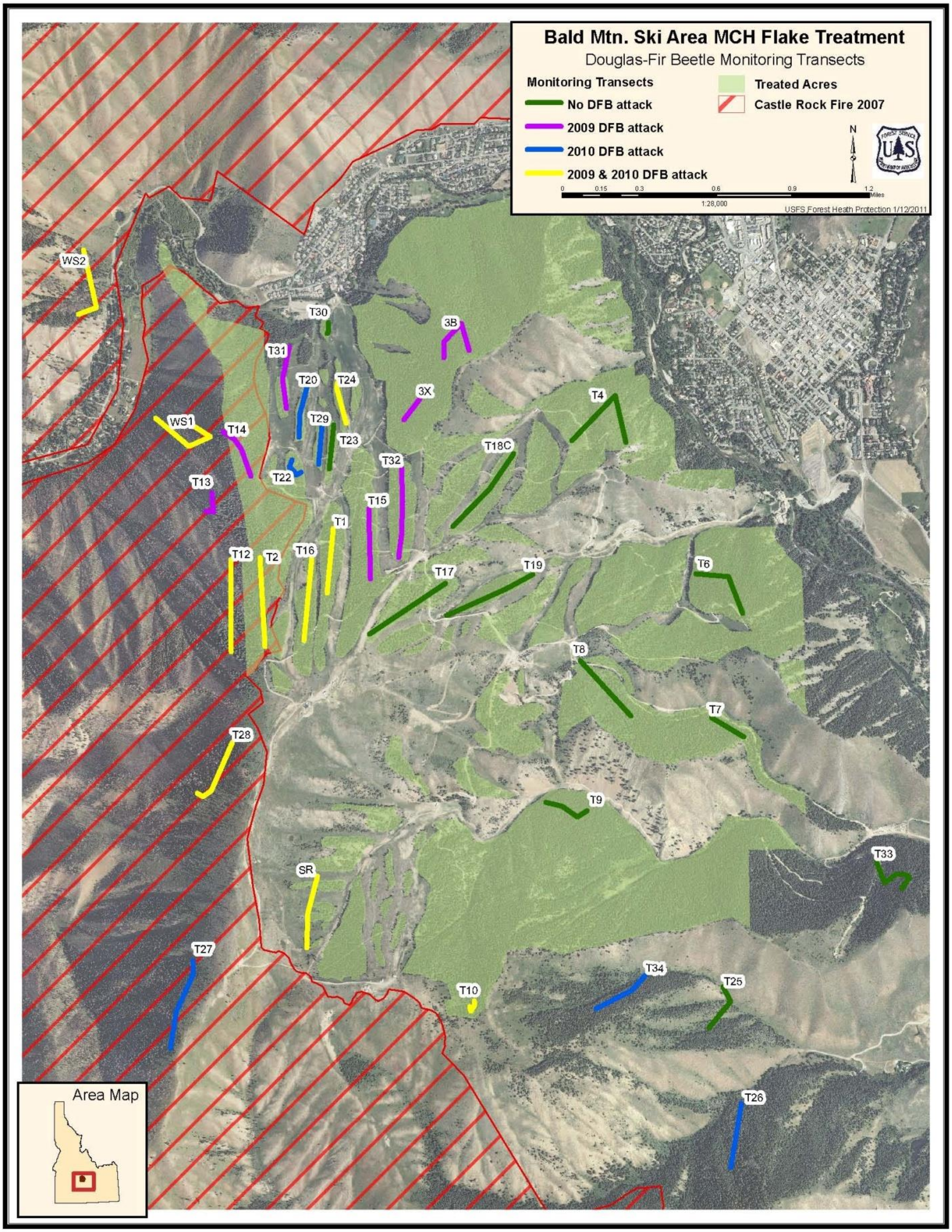
Objective and Methods

The primary objective of this monitoring effort was to determine if the 2010 MCH flake treatments successfully reduced DF mortality to susceptible stands on BMSA. A secondary objective was to estimate the DFB population level and trend in the ski area to aid in treatment recommendations for 2011.

Using ArcMap (V.9.2) and geospatial data, we subdivided the project area into smaller survey units based upon stands of similar density and host type in previously infested and uninfested areas within the ski boundary. A smaller number of transects was established in similar stands outside and adjacent to the ski boundary to provide an area comparison. At least one set of transects was paired for treated and untreated acres represented by the following conditions: burned + uninfested; burned + previously infested; unburned + uninfested; unburned + previously infested. Locations of plot transects was pre-selected (Figure 2).

Each transect was a series of ten variable radius plots spaced at least 3 chains apart. Basal area factor 20 was used to determine sample trees. Transects were placed linearly downhill or contoured along the hillside as long as suitable host was present (Figure 2). Plots were established between September 13-17, 2010. Variables recorded were tree species, diameter at breast height (d.b.h.) (inches), live/dead, evidence of DFB infestation and the type and year of attack for all plot trees over 5 inches d.b.h.

Figure 2. Location of Bald Mountain Ski Area MCH Flake Project Monitoring Plots, showing corresponding Douglas-fir beetle years of attack. Monitoring plots: variable basal area prism plots; each transect represents at least ten plots.



Data collected in surveyed DF stands was summarized using the Forest Insect and Disease Tally (FINDIT) program (Bentz 2000). The FINDIT program calculates the following statistics to determine the level of DFB-caused mortality and other stand attributes:

a. Total trees/acre (TPA).
b. Total live and dead basal area (BA sq.ft./ac).
c. Quadratic mean diameter (QMD).
d. Live stand density index (SDI).
e. Number of dead and live trees/acre.
f. Percentage of each tree species.
g. Percentage of basal area (BA) comprised of each tree species.
h. Total regeneration/acre of each tree species.
i. Percentage of basal area killed by insects and diseases.

Results and Discussion

Although many plots were sampled in treated and untreated areas, time limitations prevented widespread sampling throughout the entire project area. As a result, statistical inferences were not made for these data, and reported results are descriptive in nature. The objective of this monitoring effort and analysis was to report the overall effectiveness of the 2010 aerial application. To that end, data gathered were considered sufficient because the plots were broadly representative of stand variations found throughout the treatment area.

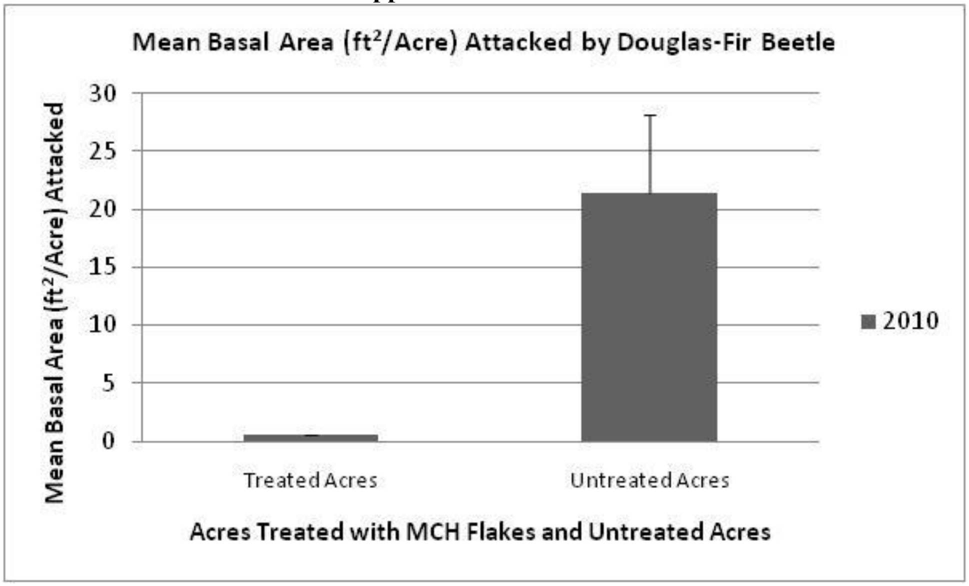
During the planning stage of the 2010 treatment, it was important to determine locations of DFB populations in 2009 and attack levels in previously infested and burned areas to judge the amount of beetle pressure still in the area. The 2010 monitoring transect placement was biased toward areas at the "edge of infestation" based upon 2009 ground surveys where DFB current attacks were highest. Impacts were thought to be especially important at this "edge" nearest the burned area along the northwest portion of the treatment area, Guyer Ridge (Figure 1). However, there were unrecorded DFB populations (shown in blue) on BMSA in 2009 that provided additional DFB pressure for our treatment (Figure 1). These DFB populations are within the 2-mile buffer around BMSA (Figure 1) and could potentially disperse to attack DF on BMSA.

Treated vs. Untreated Acres. In total, 38 areas were monitored in 2010 (Figure 2, Appendix A.): 28 were treated areas and 10 were untreated areas. By 2010, DFB attacks were found in all burned areas. It was rare to find 2008 attacks in sampled areas; however, 2009 and 2010 attacks were found in treated and untreated areas.

DFB attacked the largest trees first in both treated and untreated areas, those over 19 inches d.b.h. (Appendix A). However, attacks and mortality were recorded for DF as small as 7 inches d.b.h. In total, 67.8 percent of monitored treatment areas received the prescribed dosage of flakes. Areas that did not receive flakes were considered untreated and removed from further analysis of flake efficacy.

Before treatments in 2009, DFB attacked 7.0 ± 2.3 (TPA), representing 12.0 ± 4.4 BA ft^2/acre on average. In 2010, following treatment, DFB attacked an average of 14.7 ± 3.7 TPA, representing 21.0 BA ft^2/acre, in the untreated areas compared to an average of 0.7 ± 0.04 TPA, representing 0.5 BA ft^2/acre, in the treated areas (Figure 3).

Figure 3. Mean basal area (ft²)/acre attacked by DFB for treated and untreated sampled areas during 2010 Bald Mountain Ski Area aerial application of MCH flakes.



Efficacy of MCH Flakes for Treated Areas with Active Infestations of DFB. Certain stands were infested by DFB at the time of treatment, transects 2, 3, 3b, 3x, 14, 15 (Figure 2), with an average of 4.3 ± 0.9 TPA attacked in 2009. Those areas were considered separately from stands not infested at the time of treatment. In 2010, DFB attacked 0.3 ± 0.2 TPA in areas infested at the time of treatment, and 0 TPA were attacked in areas uninfested at the time of treatment. This suggests that MCH flakes did reduce mortality when DFB were already present in an area, especially since suitable host was available in all areas. Several times in 2010, we observed DFB reattacking the same trees attacked in 2009, especially the very large DF over 19 inches d.b.h. These trees had started to fade but fresh frass was visible on the lower stems. DFB galleries were visually inspected under the bark and current attacks of all life stages were found.

Flake Distribution. Flake distribution was inconsistent in some areas of the treatment and likely influenced DFB attack rates. Treated areas with current attacks were evaluated and only 31 percent of those areas were found to have the correct flake distribution on the ground. None of the areas that were attacked only in 2010 had the correct flake distribution throughout. Flake distribution was particularly poor in narrow stands of trees, for example transects 22, 23, 24, 29, and 31 (Figure 2). Over half of these treated areas had at least one plot per transect that was missed completely by flakes (Appendix A).

To keep this in perspective, these missed areas were mostly the narrow, stringer stands in the northwest section of the treatment area. Of those seven treated areas missed completely, 15.7 TPA were attacked on average in 2010, representing 17.1BA ft²/acre. Conversely, in areas that we properly treated at the correct rate, only one location (#2, Figure 2) suffered DFB attacks and that was only 1.4 TPA. This suggests that the flakes had an impact in confusing the beetles in 2010 in certain areas. DFB could have attacked more trees in 2010 because all stands still have suitable host to colonize.

The flake distribution was compromised in certain areas likely due to treatment block design, application technique and weather conditions. Modifications can be made in future projects to improve flake distribution and rate.

Lessons Learned:

- The applicator boom used during this treatment takes approximately one second to turn off and on. Stands were flown over before the boom sent flakes down to the ground. In the future, keep block sizes large and avoid narrow areas less than 200 meters wide.
- Flake coverage may have been affected by wind speed and height of flake release. During the May application, wind speeds varied widely from one location to the next on BMSA, often times approaching the maximum allowed (6m/h) for treatment. Throughout the second application, treatment order was reprioritized based upon wind speeds recorded by onsite observers.
- Narrow strips of the treatment area were sometimes flown up and down the slope maintaining a constant release height. This inadvertently resulted in greater flake dispersion toward the bottom of "run" than at the top. During future projects, avoid narrow treatment block sizes or maintain a constant height of release.
- Flakes were clumped together during the second application. This was probably due to warmer ambient temperatures in the laboratory when the flakes were bagged for shipment. According to Jim Heath, Hercon Environmental technical representative, cornstarch can be added to the flakes to avoid clumping.

Overall descriptive assessment of treatment efficacy. Did it work?

Overall, the flake treatment successfully reduced DF mortality from DFB, barring areas where flake dosage was inadequate. The mean BA attacked in treated acres was lower than in untreated areas and much of BMSA remained unattacked in 2010. DFB attacked more TPA in untreated areas in 2010 than in 2009, indicating the outbreak will continue in 2011 on public lands surrounding BMSA. Susceptibility to DFB remains high in all infested areas, including BMSA. Therefore, additional treatment is recommended in 2011.

MONITORING DFB FLIGHT

Objective and Methods. The main objective of trapping DFB was to determine when flight begins and ends at various elevations to time emergence and peak flight periods of DFB at BMSA. A second objective was to record temperature effects on DFB flight over the season.

Trap locations were selected based on proximity to DFB-infested areas included in the MCH treatment. However, trap locations were only placed on the ski runs, areas that were not directly included in the MCH flake treatment. Figure 4 shows the location of ten trap sets placed on the west side of BMSA along the main road leading up to the Bald Mountain lookout from the Greyhawk parking area. Traps were placed along Warm Springs road, elevation 5,700 feet, April 13, 2010, and on BMSA May 4-5, 2010, as the ground thawed enough to secure the trap poles and after the ski area closed for the season. DFB flight was monitored from May 3 to September 24, 2010, along an elevation gradient of 5,500 to 9,200 feet adjacent to the treatment area during the 2010, flight period (Figure 4).

Each trap location was composed of a set of five panel or Lindgren funnel traps spaced at least 30 feet apart along a transect easily accessible to the road and at least 100 feet from the nearest live host tree to avoid spillover effects. Panel and funnel traps were provided by FHP. Each trap was baited with a two-piece DFB Seudenol lure set (Synergy). Each trap collection cup contained one, 1-inch^2-, no-pest-strip.

Trap catches were collected every week by Ketchum Ranger District personnel. Baits and no pest strips were replaced mid-June. All collected beetles were emptied into Ziplock freezer bags and labeled with the date, location, and trap number. Trap catches were sorted in the office/lab. Sorted beetles were counted individually if there were not many per sample. When trap catches increased in late June, beetle counts were measured volumetrically from each sample and an estimated “count” recorded per trap.

Two Hobo weather stations were provided by FHP and placed at the bottom of BMSA and at mid slope May 1 to September 24. A permanent weather station provided the information for the summit (Figure 4). Temperature data were recorded for subsequent use in determining temperature correlation with flight data. Results of flight periodicity and temperature data will be used to plan treatment timing in 2011.

Results and Discussion. We began checking for DFB catches in the lowest elevation site traps along Warm Springs Road the week of May 3, trap sites 1, 2, and 3 (Figure 4). The first beetles were collected the week of May 20, and averaged three per trap (Figure 5). We did not begin to check traps on the ski area until June 2 because trap catch was still very low at the lowest elevation and access to the higher elevation traps was a problem. Trap catches increased significantly the week of June 14 averaging 144 per trap on BMSA traps and 404 in the lower Warm Springs road traps. Trap catches jumped up to 1,095 per trap the week of June 21. Trap catches dropped by a third the first week of August and catches slowed in September to an average of 15 DFB per trap. DFBs were collected through September 24, 2010. The DFB flight peak occurred from early June through the second week of August. Lessard and Schmid (1990) reported only one principal DFB flight period in Colorado, while Wood (1963) reported two principal flight periods in CA, OR, UT, one during May to June and one during July to August.

By comparison, a previous DFB trapping effort conducted near the BSMA by Sawtooth NF and Idaho Department of Lands personnel in 2007 caught an average of 152 beetles per trap by May 19 at 6500-6920 feet elevation. That year, DFB flight peaked June 13 and catches began to drop off by the first week of August. The highest weekly trap catch in 2007 was 3,510 compared to 1,070 caught in 2010. This comparison shows the variability in DFB occurrence in flight periodicity from one year to another.

Figure 4. Location of Douglas-fir beetle flight monitoring traps and weather stations associated with the Bald Mountain MCH Project, Ketchum Ranger District, 2010.

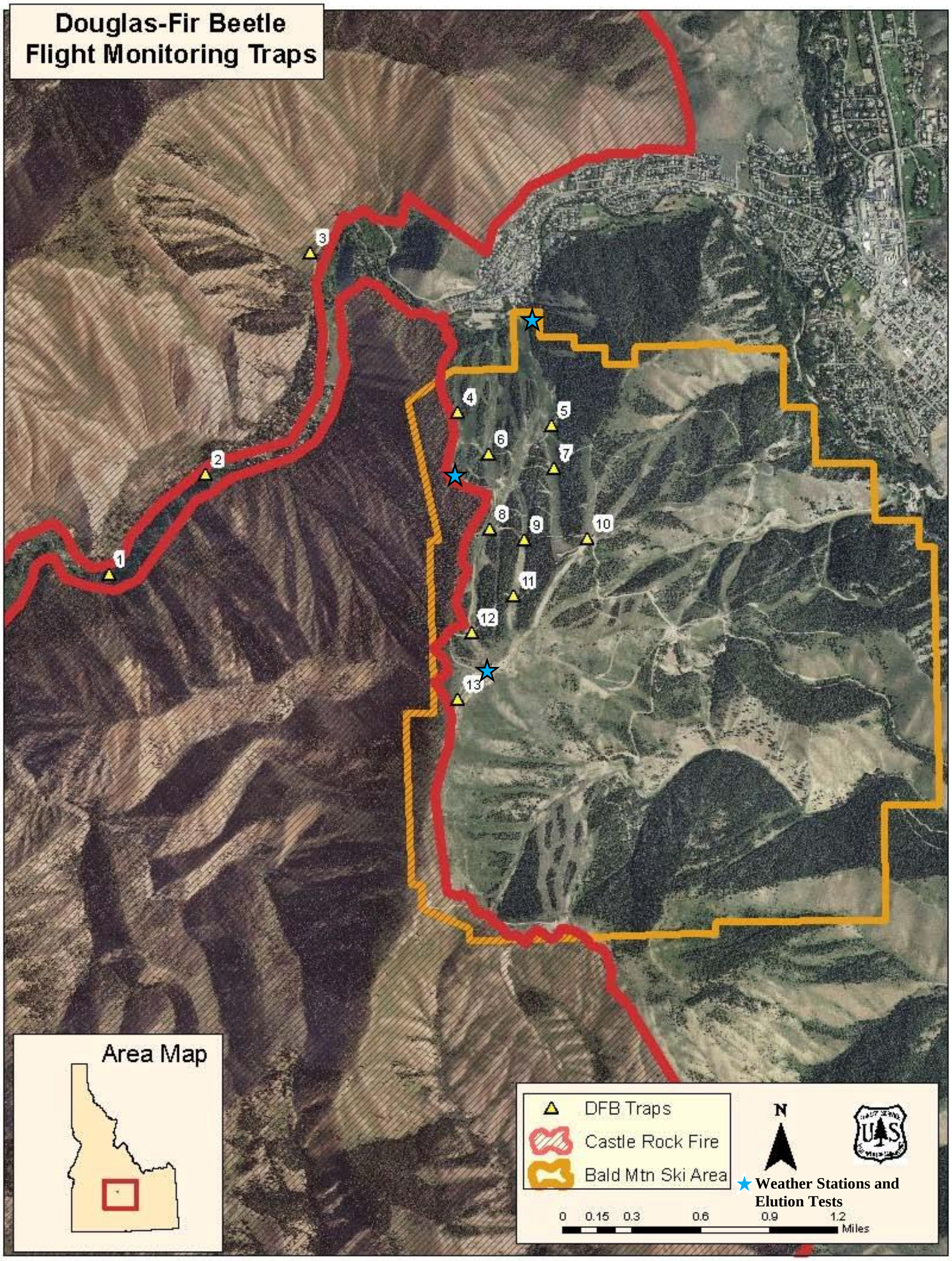
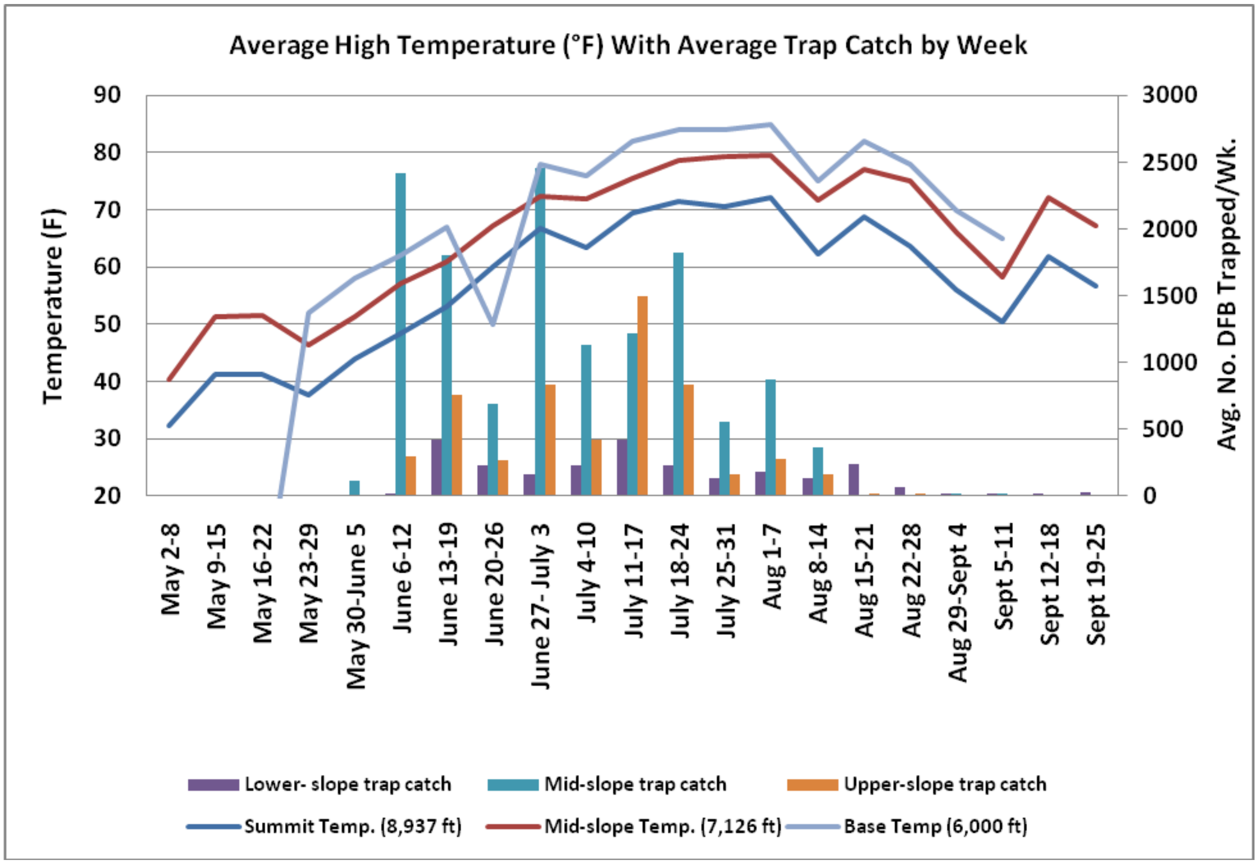


Figure 5. Douglas-fir beetle flight from May 1 to September 24, 2010 on Bald Mountain Ski Area and Warm Springs Road, Ketchum Ranger District.



DFBs fly when temperatures reach about 62 degrees Fahrenheit (Atkins and McMullen 1960). Weekly high averages were plotted in Figure 5 and contrasted with DFB trap catch numbers. There was a 10 degree temperature difference on average from the bottom of the ski hill to the summit of Bald Mountain. The lowest elevations averaged 60 degrees by the week of May 30, whereas, the highest elevations averaged 60 degrees the week of June 20. When the average weekly temperatures decreased, DFB trap catches decreased as well. For example, the cold and rainy weeks of June 20 and July 4 resulted in fewer beetles trapped.

RIPARIAN BUFFER AREA MONITORING ADJACENT TO THE TREATMENT AREA

Objectives and Methods. In response to management concerns, potential flake drift was evaluated using AGDISP Drift Model, version 8.23 (Tesk et al. 2010) and a 300-foot no-flake stream buffer was established to protect these areas. Then, five monitoring locations were established prior to treatment to determine if the 300-foot riparian buffer area along three waterways (Big Wood River, Clear Creek, and Warm Springs Creek) was adequately protected from the flake application.

Each monitoring location was systematically selected based on road access. Monitoring cloths were placed along a transect running perpendicular to the treatment area boundary toward the protected stream. Each transect began 50 feet within the adjacent treatment area, and continued through the riparian buffer zones ending at streamside (Figure 7). Monitoring cloths were placed at 50-foot intervals up to 200 feet and then one more cloth at 300 feet streamside. A total of eight monitoring cloths were placed along each transect (40 total). Each monitoring sheet was 1 yard x 3 yards of black landscaping cloth. Monitoring cloths were staked down using cloth stakes.

One observer monitored each transect during the flake application. Observers measured and recorded wind speed and wind direction at 15-minute intervals, reporting by radio to the COR when wind speeds exceeded 6 mph. Observers recorded flakes visibly falling over the monitoring cloths in the buffer area, and counted and recorded the total number of flakes on the monitoring cloth. Any observed occurrence of flakes in the buffer areas was recorded and reported to the project manager and the Contracting Officer's Representative.

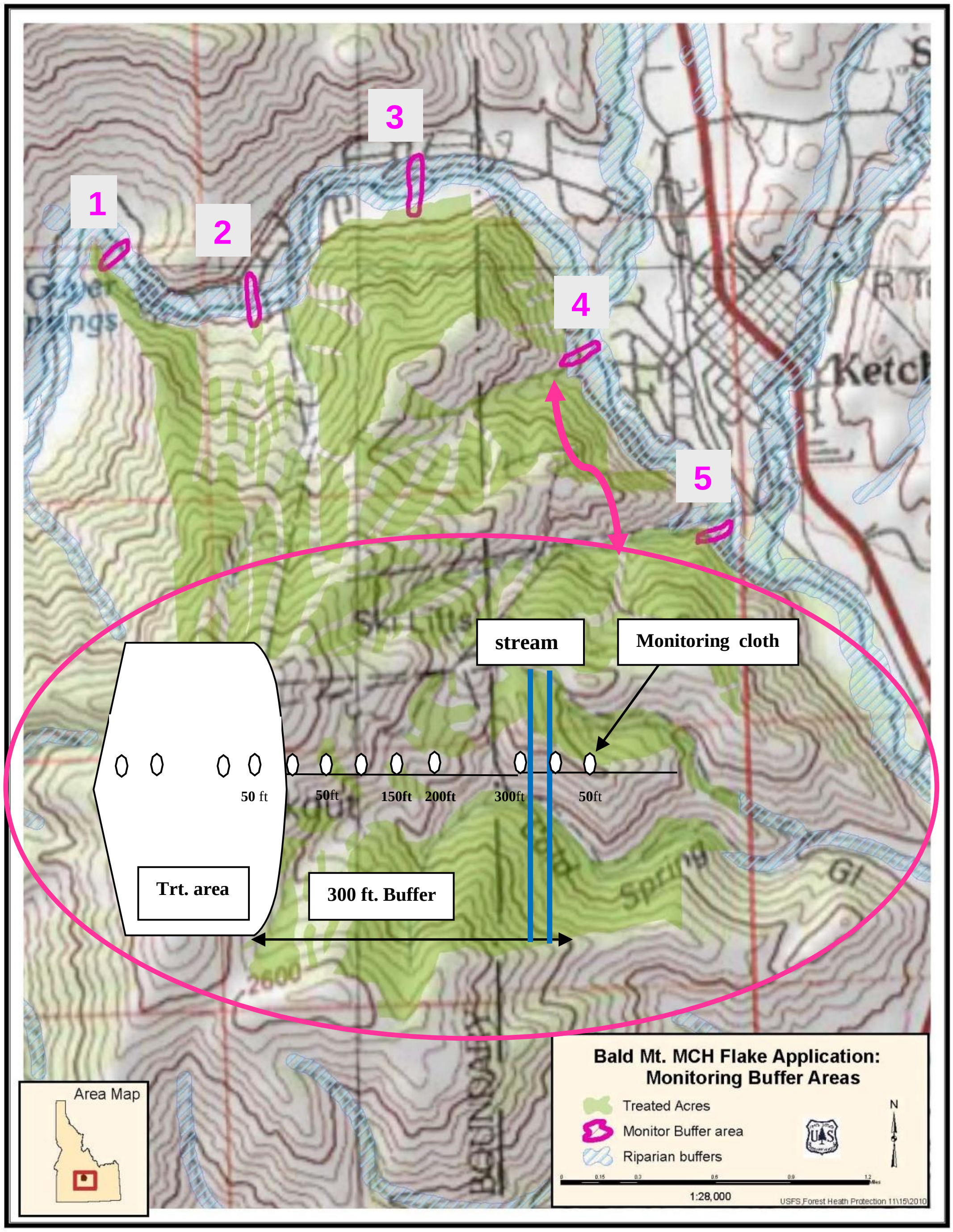
Results and Discussion. During the first application, we found only one flake in Location 2 (Figure 6). During treatment two, three flakes were found in that area, and 21 flakes in Location 3. It is very important to only apply flakes when wind levels are very low. Wind gusts approaching 6 mph may have offset the falling flakes and scattered their distribution beyond the planned treatment boundaries. Flakes may have dispersed closer to Location 2 because the pilot flew down slope to treat the narrow stands of trees nearby and the flight height may have influenced flake distribution. The application area was flown from upper slope to lower slope over nearby normal stands of trees. The directional momentum and increasing height above the canopy at the end of the application "run" may have resulted in flakes drifting into the nearby buffer area.

The monitoring cloths worked well on flat areas, but did not work well on sloped aspects. The flakes slid off the cloths on steep terrain. We were able to walk around the cloth and look for flakes in the general vicinity to further support our drift conclusions.

We also placed observers in the treatment area to monitor flakes dispersing out of the helicopter to the ground. Target flake distribution was approximately one flake per square foot. The observers noted flakes landing in their area and walked around the designated area to record flake presence or absence and general distribution. During the first application, we were only able to place an observer at the top of Bald Mountain and in the riparian buffer zones due to snow cover and road access. Later in mid-June, crews visited the treatment area to identify DFB activity and noted that flake dispersal was too heavy in some places, too light in some places, and some areas were missed entirely. These missed areas were subsequently given high priority for treatment during the second application.

Overall, the distribution was very good for the second application. We learned that boom "on/off" timing is very important when considering layout of treatment blocks because narrow blocks resulted in inconsistent distribution of flakes. During the first application, narrow treatment areas were missed perhaps because the boom timing was imprecise.

Figure 6. Location of riparian buffer area monitoring sites.



MCH FLAKE ELUTION TEST

Objective and Methods. The objective of the MCH flake elution test was to monitor the release of MCH from the supply of DISRUPT Micro-flake® MCH used in the BMSA operation, in order to ensure that the product performance was reliable. In the event of a treatment failure, this information could be used to troubleshoot the problem.

Results and Discussion. Unfortunately, elution testing was compromised and the results are inconclusive. Prior testing in the lab and in the field show that MCH flakes provide protection between 60-90 days. The Disrupt MCH flake label states that flakes provide protection for 2 months. If the flakes used in our treatment were functional, then we would have provided adequate protection from May through the end of August. DFB flight was much reduced through mid-September (Figure 2). Therefore, if the flakes were eluting correctly, we should have had adequate protection through August and perhaps into September.

RECOMMENDATION ALTERNATIVES FOR 2011

To prevent unacceptable DF mortality and meet management objectives, portions of BMSA should be treated in 2011. DFB populations are still very active in and around the 2007 Castle Rock fire area and in portions of BMSA. New attacks should be expected in 2011 at levels observed in untreated areas during 2010 or slightly less. DFB populations will likely vary next summer based on 2011 snow pack and ambient temperatures throughout the flight period, mid-May to September. Attacks may wane if snow pack is high and early summer temperatures are cool. This will be the fourth flight season after the fire and DFB outbreaks following fire rarely last longer than 6 years. There are several things to consider when deciding on 2011 treatment alternatives, including cost of treatment options, acceptable levels of mortality, general locations of acceptable mortality, and safety of personnel during applications.

FHP 2011 funding will not allow for two aerial MCH treatments in 2011, nor are two applications warranted. Elution of MCH flakes will not cover the entire 4- to 5-month flight of DFB, but are likely effective over the critical DFB flight period. With a properly timed application, one treatment in early June will provide protection through mid-August covering most of the critical DFB flight period. There will still likely be DFB flying in August and some in September but by then the flight should be diminished and result in fewer attacked trees.

While MCH flakes at the 150 A.I. dose appears to have reduced mortality from DFB compared to non-treated areas, the mortality that did occur in treated stands was concentrated in areas with active DFB populations within or immediately near treated stands. The higher label dosage of 300 A.I. may be more effective at preventing DFB attack in areas with active DFB populations. Treatment acreage estimates in the following alternatives are reduced from 2010 treated acres. Areas that were treated in 2010 but are excluded from 2011 recommendations are those unhealthy, diseased stands of low susceptibility to DFB. I recommend Alternative 2: Use of a combined treatment of MCH flakes and pouches.

ALTERNATIVES

1. **Do Nothing.** Results of our monitoring surveys indicate that DFB populations are still active in and around the BMSA and if untreated, will likely result in unacceptable levels of DF mortality. As much as 15 TPA, representing 25 square ft BA per acre, may be attacked in any given infested stand if no treatment is done in 2011. Due to the proximity of current DFB populations to susceptible stand conditions, Central Park and other high priority stands are at high risk for attack in 2011.

2. **Apply one well-timed application of a combined treatment of MCH flake (150 A.I. and 300 A.I) in some areas and MCH pouches in others.**

***Rationale*:** A higher dose (the label rate) of MCH flakes is recommended for areas already infested with DFB or where adjacent stands are infested. The higher label dosage of 300 A.I. may be more effective at preventing DFB attack in areas with active DFB populations. Recent communication with Hercon Environmental supports the 300 A.I. label rate dose for use where DFB populations are high. The lower dose used in the 2010 treatment will provide protection for slightly lower priority areas or where there is less DFB pressure. MCH pouches are recommended for the area around Central Park because there is a high risk of attack from adjacent, infested stands. DF mortality is unacceptable in regards to management objectives in these areas and there is a chance that the aerial flake distribution could be uneven due to sudden wind gusting.

Specific treatments

b. A higher dose of MCH flakes applied to 530 acres, areas shown in yellow (Figure 7).

c. A lower dose of MCH flakes applied to approximately 840 acres, stands shown in blue (Figure 7).

d. MCH pouches applied in high priority areas including Central Park and surrounding stands, and single tree protection of the remaining large diameter DF, in areas including 16, 11, 31, and 22 shown in pink (Figure 7).

Estimated Costs

Pouches applied from ground: 125 acres treated with MCH pouches.
Cost of pouches = **$5,000.00 for 5,000 pouches** (40 pouches/acre x 125 acres x $1.00/pouch)
Personnel = **$7,000.00** (1 acre treated in 2 hours. 1 person can treat 125 acres in 250 hours. 250 person hours = 125 acres = 7 people for 36 hours, or 4.5-5 8-hour days. Average cost of $200 per day (GS-7). 7 x 5 x 200 = $7,000 + $5,000 for pouches = $12,000.)
Total pouch deployment cost ***= $12,000.00***

Flakes applied aerially:
Flakes:
300 A.I. = **$100,000.00** ($160.00/acre x 622 acres)
150 A.I. = **$67, 000.00** ($80.00/acre x 837 acres)
Total cost of flake products = ***$167, 000.00***
Personnel **= $29,000.00**
Aviation Contract = **$59,000.00** (1,459 acres x $0/acre)
Supplies: shipping, baits, rental truck = **$5,000.00**
Total Cost of Flake Treatment ***= $260,000.00***
Grand Total for Alternative 2: $272,000.00 (pouches + flakes)

Advantages and Disadvantages of Ground Deployment of Pouches*:* Advantages are that pouches provide protection from DFB over 120 days when deployed correctly. Pouches are thought to provide protection to green trees in stands already attacked by DFB. Disadvantages are that successful deployment of pouches at the recommended label rate of 40 pouches per acre was very difficult and marginal at best, based upon past experience from 2009 under similar conditions. Additional disadvantages are that deployment of pouches on steep, potentially dangerous terrain and dense stands would be difficult even in skiable snow during early spring. A later deployment would be risky in terms of both personnel safety and synchronicity of pouch deployment with DFB flight, depending on snow pact and spring temperatures in 2011.

Advantages and Disadvantages of Aerial Application of Flakes*:* Advantages are that the actual aerial application of MCH flakes is fast, occurring over a few days on very steep terrain. Flakes reduced mortality in treated areas following treatment on BMSA in 2010. Disadvantages are that flake coverage can be inconsistent for a variety of reasons that include narrow treatment blocks that do not allow for adequate boom on/off time, high wind speeds, or flakes are released too high. Flakes provide protection for 60-90 days and will not protect the areas for the entire DFB flight since a small proportion of DFB will fly through September.

3. Apply one well-timed application of MCH flakes to approximately 1500 acres in all designated treatment acres at the rate used in 2010, 150 A.I. Deploy MCH caps in the highest priority areas, limited to ~125 acres (Figure 8).

Rationale: MCH pouches may be more effective where DFB is active within high priority stands. Elsewhere, one flake application at 150 A.I. should afford acceptable protection. We would adjust the treatment area so that it excludes stands that have low susceptibility to DFB attack, for example 4 and 8 in Figure 2.

Costs:

Pouches: 125 acres = **$5, 000.00** (125 acres x 40/acre = 5,000 pouches)
Personnel: **$7,000.00** (same as Alternative No. 2)
Flakes: 150 A.I. dosage = **$120,000** ($80.00/acre x 1,500 acres)
Aviation contract = **$60,000.00** (1,500 acres x $40/acres)
Total Flake application **=** *$180,000.00*
Grand Total for Alternative 3 = $192,000.00

Advantages and Disadvantages of Ground Deployment of Pouches*:* Advantages are that pouches provide protection from DFB over 120 days when deployed correctly. Pouches are thought to provide protection to green trees in stands already attacked by DFB. Disadvantages are that successful deployment of pouches at the recommended label rate of 40 pouches per acre was very difficult and marginal at best, based upon past experience from 2009 under similar conditions. Additional disadvantages are that deployment of pouches on steep, potentially dangerous terrain and dense stands would be difficult even in skiable snow during early spring. A later deployment would be risky in terms of both personnel safety and synchronicity of pouch deployment with DFB flight, depending on snow pact and spring temperatures in 2011.

Advantages and Disadvantages of Aerial Application of Flakes*:* Advantages are that the actual aerial application of MCH flakes is fast, much faster than alternative 4, occurring over a few days on very steep terrain. Treatment area and costs of product and personnel is already known and will be cheaper than alternative 2. New attacks would be reduced in treated areas at rates similar to the 2010 treatment since DFB population levels are similar. Disadvantages are that flake coverage can be inconsistent for a variety of reasons that include narrow treatment blocks that do not allow for adequate boom on/off time, high wind speeds, or flakes are released too high. Flakes provide protection for only 60-90 days and will not protect the areas for the entire DFB flight since a small proportion of DFB will fly through September, compared to the 120 days of protection afforded by MCH pouches.

4. Deploy MCH pouches over the high priority areas where feasible. Deploy pouches on up to 3 blocks of 500 each (Figure 9).

Rationale: MCH pouches will reliably elute over the entire flight period of DFB and will likely protect susceptible trees in stands with preexisting populations.

Cost**:**

Pouches **= $20,000.00 (**500 acres x 40/acre x $1.00/pouch)
Labor = **$28,000.00** (4 x labor costs incurred for pouch deployment, Alternative No. 2)
Total Cost for 500 acres = $48,000.00
Grand total for alternative 4: 3 blocks of 500 acres = $144,000.00 (54 days needed for 7 people to deploy pouches)

Advantages and Disadvantages of Ground Deployment of Pouches*:* Advantages are that pouches provide protection from DFB over 120 days when deployed correctly. Pouches are thought to provide protection to green trees in stands already attacked by DFB. Finally, the MCH pouch deployment strategy is cheaper than an aerial application of MCH flakes. Disadvantages of a pouch deployment suppression strategy are that successful deployment of pouches at the recommended label rate of 40 pouches per acre was very difficult and marginal at best, based upon past experience from 2009 under similar conditions. Additional disadvantages are that deployment of pouches on steep, potentially dangerous terrain and dense stands would be difficult even in skiable snow during early spring. A later deployment would be risky in terms of both personnel safety and synchronicity of pouch deployment with DFB flight, depending on snow pact and spring temperatures in 2011.

Additional time and funding will need to be budgeted for other activities associated with the above treatments. These activities would include DFB flight monitoring and MCH flake elution testing. The estimated cost of these additional activities would vary by treatment but would be approximately $7,000.00 (personnel = $180/day x 22 days = $4,000; elution testing = 10 sample dates x 3 locations x $75.00/sample = $3,000).

A prudent treatment, concentrating efforts in the highest priority and most susceptible stands should result in protection of acres so the next phase can begin: implementation of the vegetation management plan for BMSA. In the future, FHP suppression dollars for use on the ski area will be contingent upon active management efforts to reduce the susceptibility of these acres to DFB by silviculturally altering stand conditions.

Figure 7. 2011 Proposed treatment on Bald Mountain Ski Area: Alternative 2.

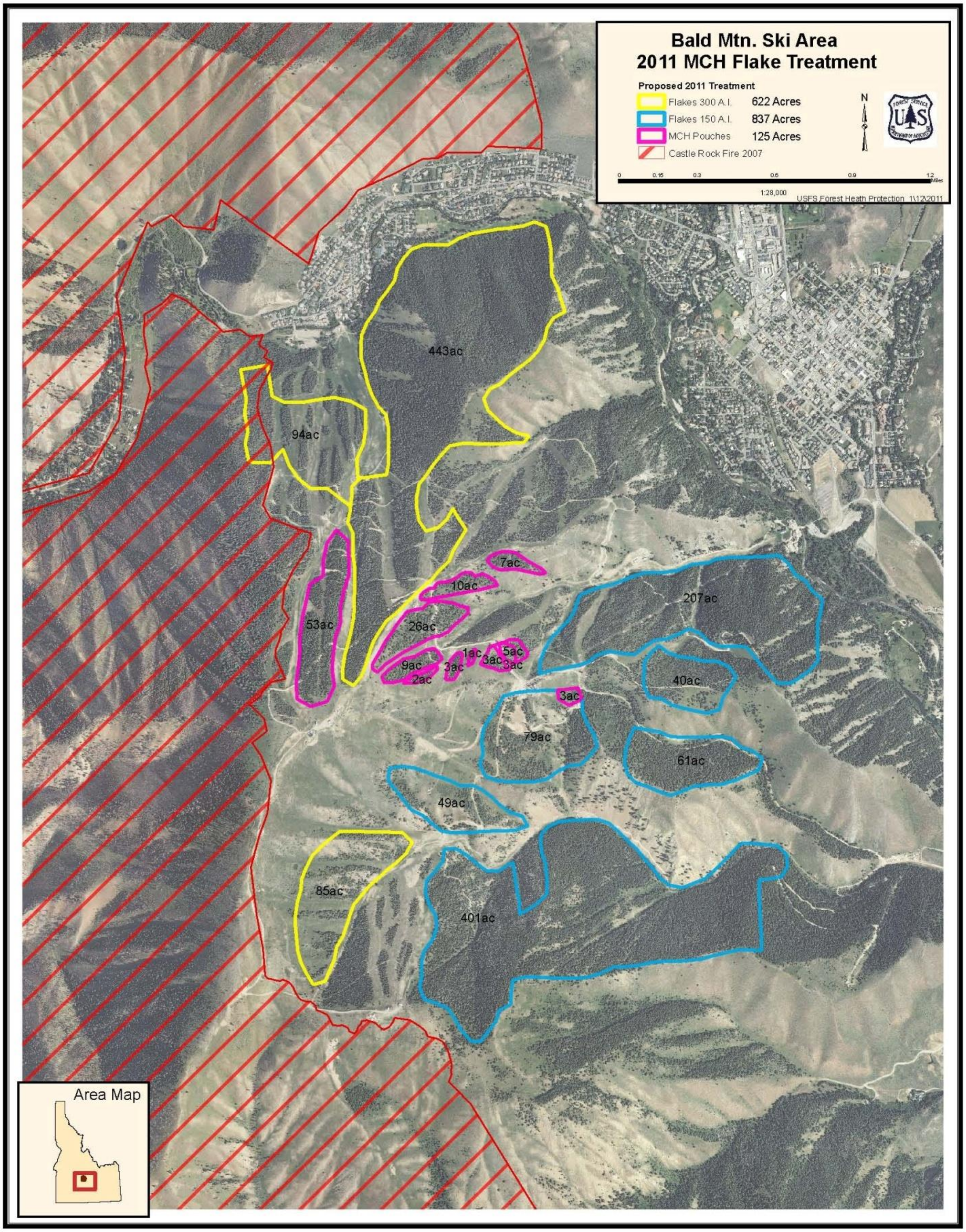


Figure 8. 2011 Proposed treatment on Bald Mountain Ski Area: Alternative 3.

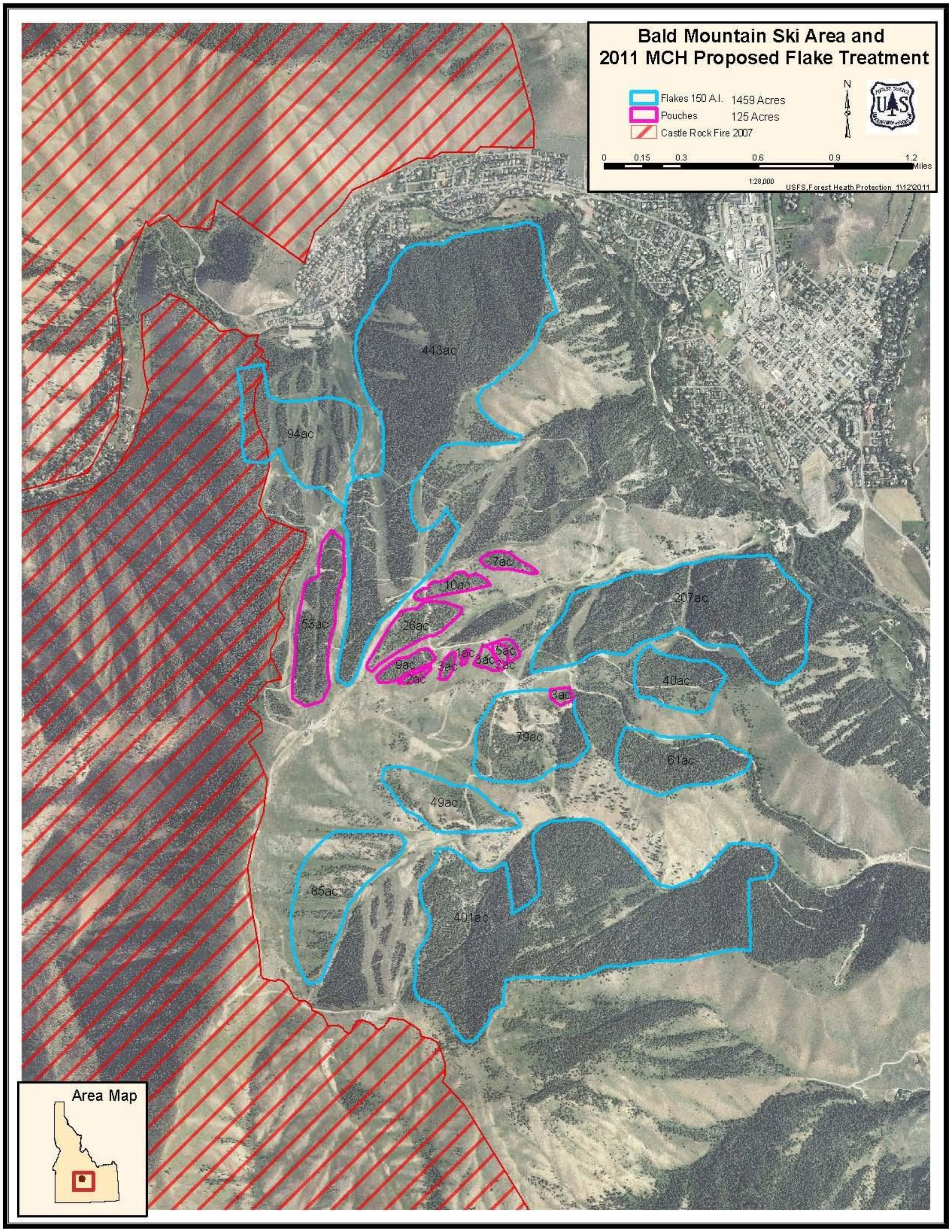
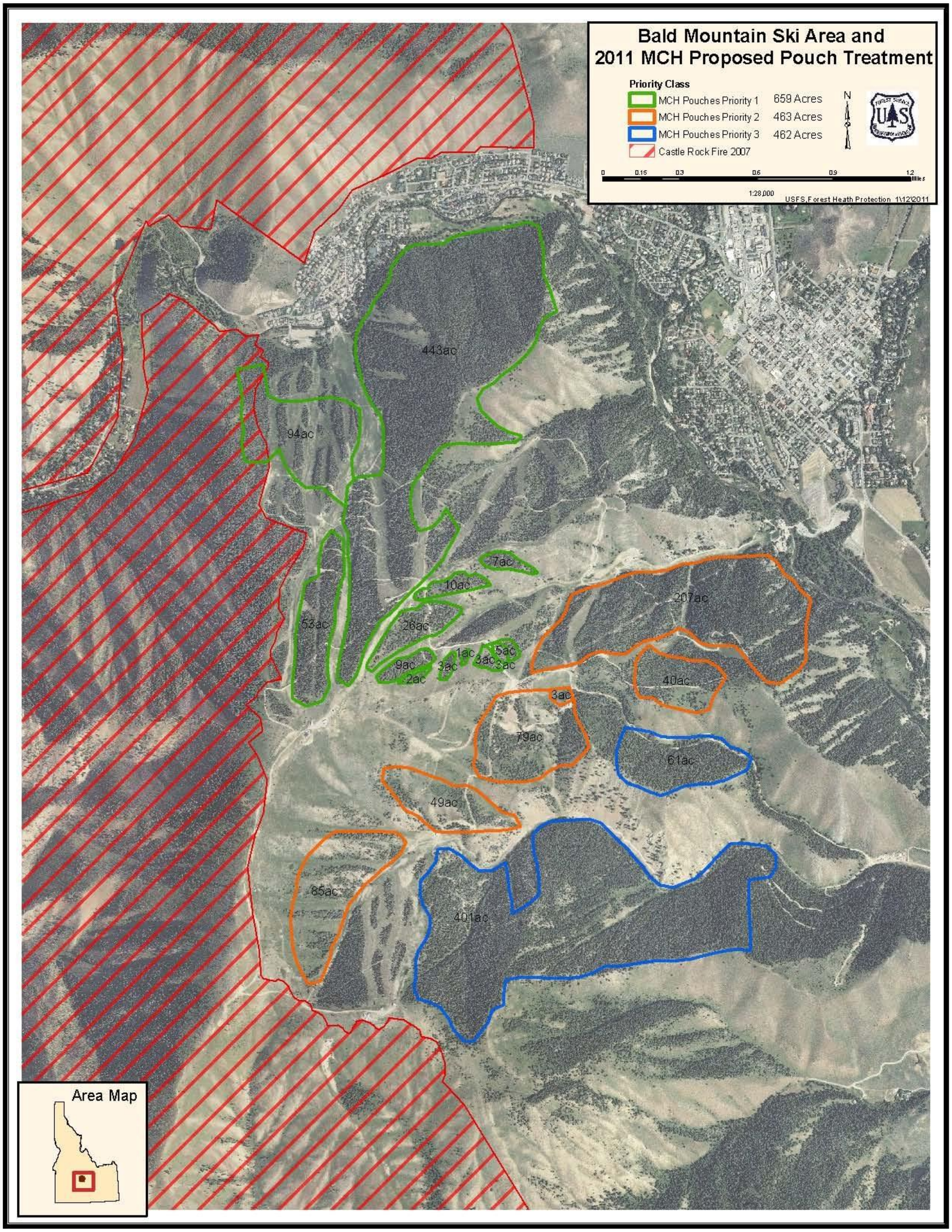


Figure 9. 2011 Proposed treatment on Bald Mountain Ski Area: Alternative 4.



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APPENDIX A. Aerial treatment of MCH flakes on Bald Mountain Ski Area, Ketchum Ranger District: All monitoring transects include ten variable radius plots per transect, 20 BAF, installed in treated and untreated acres September 2010.

TRANSECT	YEAR ATTACKED	AVG d.b.h.	DF BA Remaining >13" d.b.h.	% Plots with Correct Flake Distribution	AVG TREES PER ACRE (TPA)				
					Total DF*	Current Live DF	Attacked 2009	Attacked 2010	% Attacked >19"
	TREATED ACRES								
BURNED									
14	2009	14.3	86	100	259	225	4.5	0	68.9
2	2009,2010	18.3	64	100	116	66	6.6	1.4	82.1
SUBTOTALS		***16.3***					***5.5***	***0.7***	***75.5***
UNBURNED									
3	None	20.4	248	100	153	149	0	0	0
3A	None	15.6	140	100	320	278	0	0	0
3B	2009	15.8	132	100	306	275	2.2	0	0
3X	2009	14.3	90	100	211	171	2.5	0	100
4	None	9.2	32	100	180	145	0	0	0
6	None	18.5	112	100	186	186	0	0	0
7	None	21.7	192		148	137	0	0	0
8	None	19.2	262	70	275	261	0	0	0
9	None	13.2	104		360	313	0	0	0
10	2009,2010	21.7	30	100	207	-----	-----	-----	-----
15	2009	14.5	66	75	318	306	5.8	0	25.9
17	None	25.9	124	100	41.5	39.5	0	0	0
18	None	18.6	64	100	145	124	0	0	0
19	None	18	60	33	38	37	0	0	0
30	None	16.1	170	0	275	273	0	0	0
31	2009	14.3	90	0	211	172	2.5	0	100
32	2009	14.2	----	54	153	183	101.9	0	0
11	None	13.2	104	100	374	313	-----	------	------
16	2009,2010	16.4	48	70	88	60	20.4	1.2	55
20	2010	11.9	42	90	299	287	0	12.6	0
22	2010	11.9	22	25	118	75	0	25.1	13.4
23	None	10.9	24	60	609	573	0	0	0
24	2009,2010	12.7	80	50	395	323	3.7	12.1	5.7
29	2010	11.0	32	10	624	574	0	40.1	0
1	2009,2010	17.2	54	50	112	81	17.2	12.2	41.6

TRANSECT	YEAR ATTACKED	AVG d.b.h.	DF BA Remaining >13" d.b.h.	% Plots with Correct Flake Distribution	AVG TREES PER ACRE (TPA)				
					Total DF*	Current Live DF	Attacked		% Attacked >19"
							2009	2010	
S.R.	2009,2010	23.8	156	88	106	85	13.4	6.4	90.4
SUBTOTALS		***16.2***					***7.1***	***4.6***	***18.0***
TOTALS TRT		***16.2***	***140***				***6.3***	***2.6***	***46.7***
	UNTREATED ACRES								
BURNED									
12	2009,2010	18.5	54	10	59	40	7.5	3	68
13	2009	17.2	120	90	130	104	1.1	0	100
27	2010	17.4	122	100	202	188	0	3.6	66.7
28	2009,2010	23.7	48	50	22	21	0.69	0.64	100
WS1	2009,2010	18.8	52	100	149	64	16.5	23.9	45.8
WS2	2009,2010	20.2	96	90	125	87	4.6	22.8	45.1
SUBTOTALS		***19.3***					***5.1***	***9.0***	***70.9***
UNBURNED									
25	None	20.2	94	100	106	106	0	0	0
33	None	19.0	100	30	115	111	0	0	0
26	2010	20.6	71	100	77	42	0	7	74.3
34	2010	16.3	126	100	242	200	0	39.9	38.5
SUBTOTALS		***19.0***					***0***	***11.7***	***28.2***
Totals UNTRT		19.2					2.5	10.4	49.6

* Includes DF mortality prior to 2009.